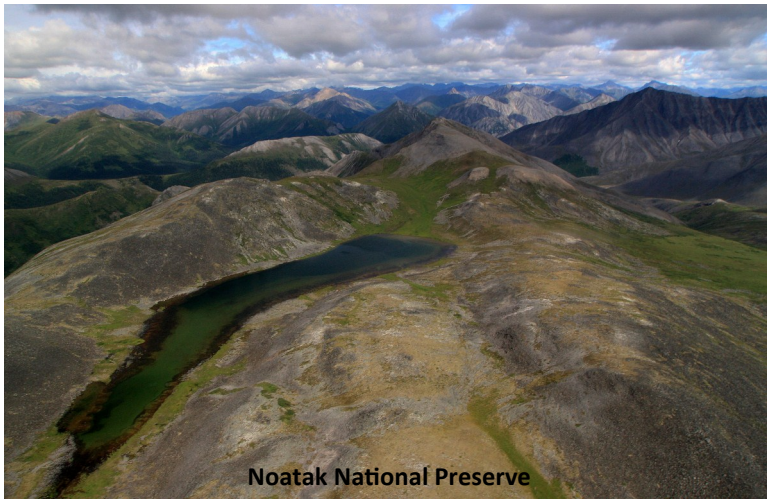
Arctic Network Newsletter

Alaska Region Inventory & Monitoring Program

National Park Service

Arctic Network Inventory and Monitoring Program (ARCN)

Our mission is to collect scientifically sound information through natural resource monitoring to contribute to park management and facilitate park preservation for future generations. We work in Bering Land Bridge National Preserve (BELA), Cape Krusenstern National Monument (CAKR), Gates of the Arctic National Park and Preserve (GAAR), Kobuk Valley National Park (KOVA), and Noatak National Preserve (NOAT).



Noatak National Preserve

Our Network is Alaska's 5 northern National Parks

In this issue

Science for the stewardship of Arctic Parklands

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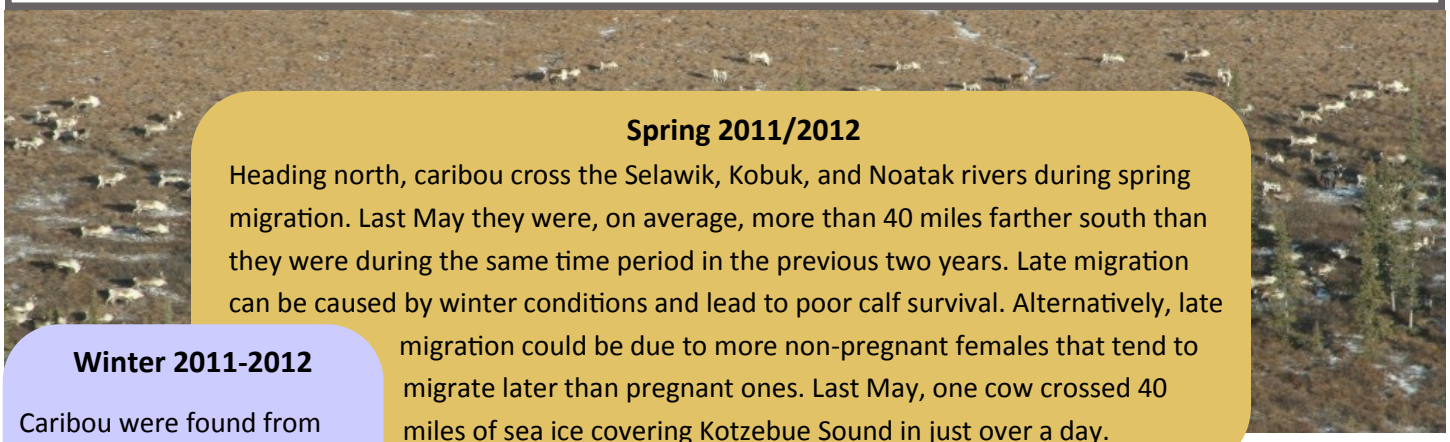
Salmon Lake, Bering Land Bridge National Preserve

To learn more about ARCN and our recent activities visit http://science.nature.nps.gov/im/units/arcn/. You can check out our latest videos about monitoring shallow lakes and thermokarst on the AlaskaNPS channel. http://www.youtube.com/user/AlaskaNPS

Seasons for caribou

Our monitoring of the Western Arctic Caribou Herd (WAH) began in 2009 in cooperation with the Alaska Department of Fish and Game, the Fish and Wildlife Service, and the Bureau of Land Management. Since that time over 65 GPS collars have been deployed which have collected well over 100,000 caribou locations. The herd used all 5 ARCN parks between 2010 and 2012. For more information, contact Kyle Joly: kyle_joly@nps.gov



Spring 2011/2012

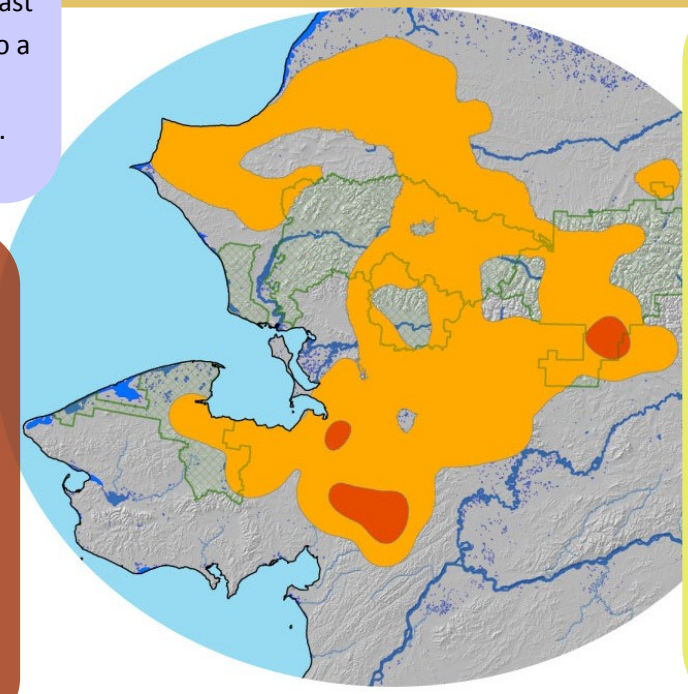
Heading north, caribou cross the Selawik, Kobuk, and Noatak rivers during spring migration. Last May they were, on average, more than 40 miles farther south than they were during the same time period in the previous two years. Late migration can be caused by winter conditions and lead to poor calf survival. Alternatively, late migration could be due to more non-pregnant females that tend to migrate later than pregnant ones. Last May, one cow crossed 40 miles of sea ice covering Kotzebue Sound in just over a day.

Winter 2011-2012

Caribou were found from Wainwright to Allakaket last winter. Both BELA and, to a lesser extent, GAAR were utilized during the winter.

Fall 2010/2011

Southward bound during the fall, the herd crossed the Noatak, Kobuk, and Selawik Rivers generally between September 24 and October 19. In 2011, five caribou migrated down the Baldwin Peninsula, just west of Kotzebue.



Annual (September 1 – August 31) range use of the Western Arctic Caribou Herd. Light orange depicts a broad area of use and dark orange represents a core area. Park units are outlined in green.

Summer 2012

Collared caribou were primarily north of park units during calving and northwest during insect relief periods; a time when mosquitos, nasal bots and warble flies all plague caribou. In July 2012, approximately 300,000 caribou from the herd came together near CAKR and NOAT. As insect harassment diminishes, the group splinters as quickly as it formed and animals spread out all over the North Slope and Brooks Range before coming together again for the fall migration.

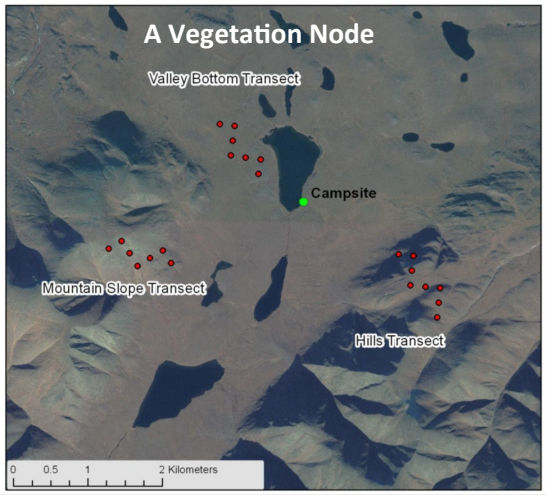
During fall and spring migration, caribou cross Onion portage, on the Kobuk River, as they have for more than 10,000 years. Here in the water is the safest way for biologists to capture and collar caribou. Last year at Onion Portage, approximately 65 % of collared cows appeared to have a calf at heel.

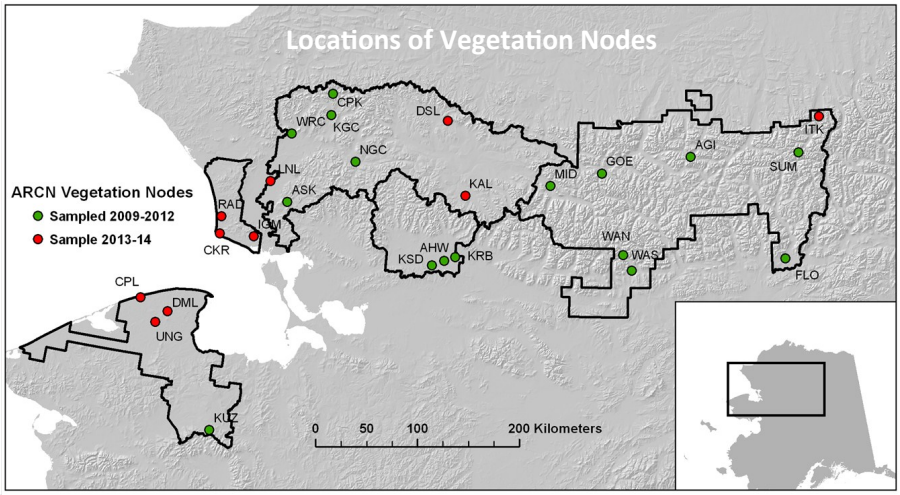
WAH caribou exhibit some of the longest migrations of any terrestrial mammal- 1,900 miles (3,100 km) each year.

Vegetation is the *basis* for ecosystem productivity and wildlife habitat. Arctic vegetation is very sensitive to climate change and disturbance such as fire, grazing, traffic and contaminants and competition from other plants.

Long-term changes in plant structure (height and density) and community, such as the northward expansion of shrubs, can affect other attributes of ecosystem structure and integrity. For this reason, we monitor vegetation at plots across ARCN parks. We use this fine-scale information together with aerial photographs and satellite images, to assess change over large areas.

In 2012, we measured vegetation at 143 plots or 8 nodes (sites with roughly 20 8- meter radius plots; pictured below) in GAAR and KOVA. To date, we have sampled 16 out of 25 nodes planned in ARCN (301 plots), the remaining ones are scheduled to be sampled this coming summer. Sampling of the nodes is over half completed. We will re-visit nodes and collect information every 10 to 15 years. For more information, contact Dave Swanson: dave_swanson@nps.gov.



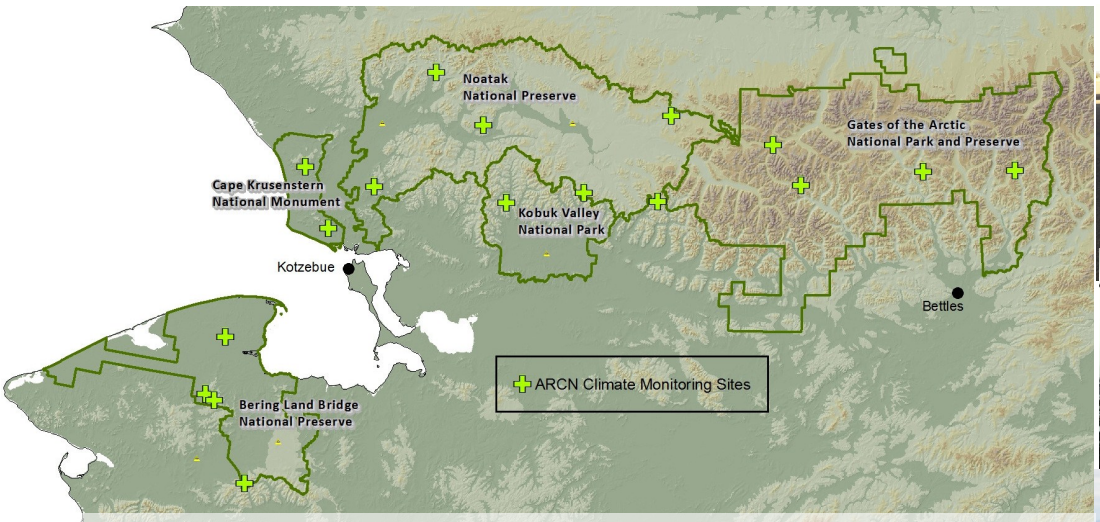


Abundant lichens in the Arctic provide biodiversity and important forage for caribou and reindeer. Grazing, competition from other plants, fires, and contaminants could lead to decreased lichen diversity and biomass in the future. Part of monitoring vegetation includes monitoring lichen composition and diversity at large (35 meter radius) plots. In order to monitor grazing impacts on lichen communities, we established grazing exclosures near these lichen plots.

No reindeer and caribou allowed near these luxuriant lichen mats- In order to monitor grazing impacts on lichen communities, we erected 18 exclosures (pictured below) in BELA last summer in areas ranging from lowland shrub-tussock tundra to alpine tundra. We sampled permanent vegetation monitoring plots in and outside of the exclosures. We expect to monitor the exclosures for up to 50 years.

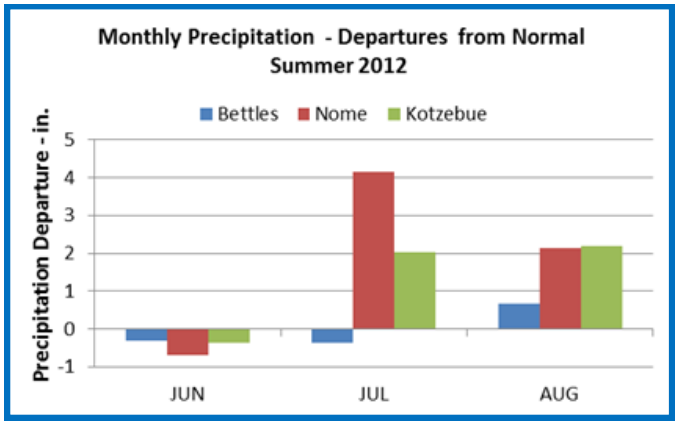
Lichen it- In GAAR last summer, we established 79 lichen diversity monitoring plots– completing our coverage of all ARCN parks. These plots span across the park along an elevation gradient ranging from 500 to 6000 ft. above sea level. We made nearly 1500 field identifications of lichens and collected between 2000-3000 samples—filling 5 Alaska bush-order size boxes! We documented hundreds of species of lichens, many of which are new species for GAAR and are poorly documented in Alaska.

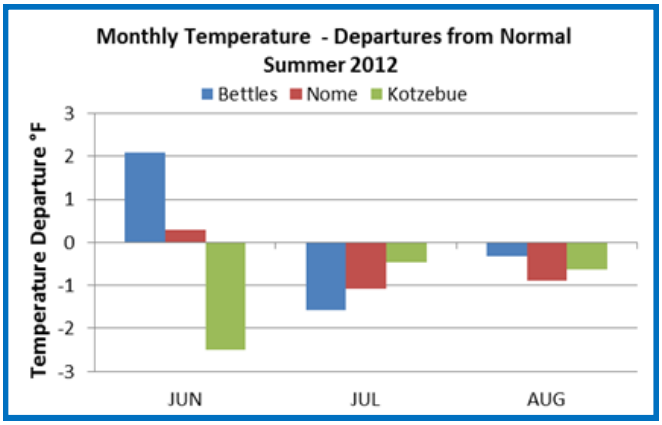
"Climate is what you expect and weather is what you get." —and we are interested in both!



We monitor and record **weather** conditions at representative locations across all 5 parks in order to identify long and short term trends (**climate**). Fifteen of seventeen proposed climate stations are now installed in the five ARCN parks. These new NPS sites are strategically located in upper elevations of the parks to complement low elevation weather stations (Kotzebue, Nome, Bettles) in the region that have been operating for many decades. Long-term records from the low elevation stations are critical to the program and will be used as index sites to determine monthly, annual, and seasonal departures from normal (see data summaries below). The new NPS sites will provide information on temperature and precipitation gradients, climate variability, and extreme events. Real-time and archived data from the climate stations are now available through the Western Regional Climate Center web site at http://www.raws.dri.edu/wraws/akF.html. For more information, contact Pam Sousanes: pam_sousanes@nps.gov

Data from the low elevation climate index stations





Summer 2012 (Jun - Jul - Aug)	Bettles	Nome	Kotzebue
Average Summer Temperature (°F) /*1981-2010 Normal*	57.0 / *56.9*	49.5 / *50.0*	49.5 / *50.7*
Maximum Temperature (°F) / *Date*	79 / *Jun 24*	76 / *Jun 2*	71 / *Jul 12*
Minimum Temperature (°F) / *Date*	35 / *Aug 9*	30 / *Jun 2*	27 / *Jun 2*
Total Summer Rainfall (In.) / *1981-2010 Normal*	6.37 / *6.46*	11.9 / *6.31*	8.04 / *4.21*

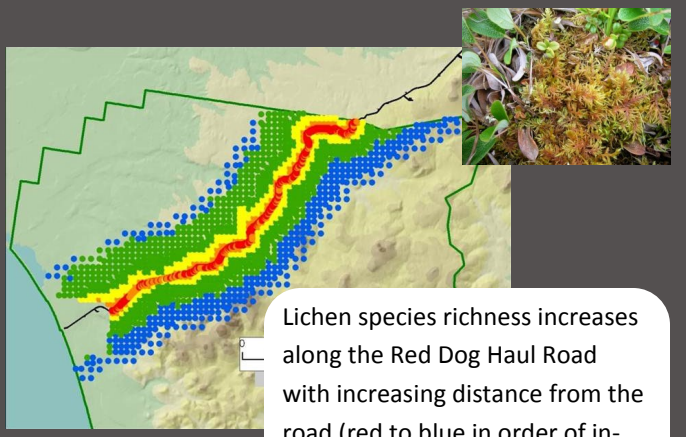
We tested the stations in Fairbanks before deployment. However, remote Arctic locations will continue to pose challenges…

Checking for contaminants

The steady input of contaminants from both local and global sources make pollution a primary concern in ARCN. Increasing loads of sulfur and nitrogen from Asian coal-burning has the potential to seriously degrade tundra, and alpine and boreal forest vegetation. These communities are dominated by lichens and mosses that are highly sensitive to these pollutants. Furthermore, heavy metals including mercury and organic toxins accumulate and magnify up through the food chain– compromising the health of subsistence foods. Sources of contaminants in ARCN parks include point sources (e.g., heavy metals from Red Dog Mine), regional sources (e.g., industrial development in northwest Alaska), trans-pacific and trans-polar global pollution sources (e.g., semi-volatile organic compounds from Asia). We assess baseline levels of, and monitor contaminants (wet and dry) in, *Hylocomium* (moss), picivorous freshwater fish, and yellow-billed loons.

LICHENS AND MOSSES

Non-vascular plants are highly sensitive to pollutants. Moss tissue from vegetation and lichen plots (see page 3) is monitored for heavy metals. We also monitor spatial patterns of metal deposition in CAKR along Red Dog Haul Road. This year we collected samples of the moss *Hylocomium splendens* from each of the vegetation plots to be analyzed for elemental composition of the following elements: Total S, Total N, P, K, Ca, Mg, Na, Al, Fe, Mn, Zn, Cu, B, Pb, Ni, Cr, and Cd. For more information, contact Peter Neitlich: peter_neitlich@nps.gov



Lichen species richness increases along the Red Dog Haul Road with increasing distance from the road (red to blue in order of increasing richness).

YELLOW-BILLED LOONS

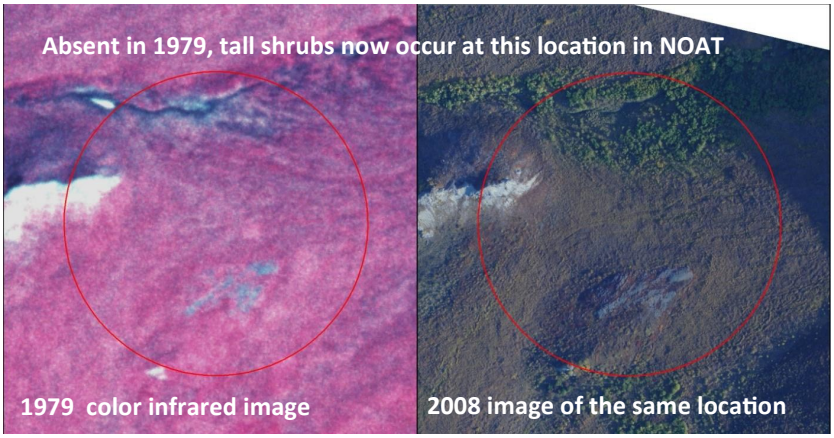
Determining contaminants concentrations in yellow-billed loons in western Alaska is important for the persistence of the species and because they are indicators of contaminant loads - including those that can affect human health- in freshwater and marine environments. Contaminant exposures can impact adult loon survival but probably has greater impacts on reproductive success. As part of a joint effort with the US Fish and Wildlife Service last June, we collected 13 eggs and samples of prey fish from nine lakes in CAKR and BELA where loons nested. These samples will be tested for metals including mercury, and persistent organic pollutants (POPs). For more information, contact Melanie Flamme: melanie_flamme@nps.gov

FISH

Lake trout, northern pike, and other resident freshwater fishes provide efficient samples to track certain persistent contaminants, such as mercury, that are atmospherically deposited into aquatic systems. With help from USFWS, during summer 2012, we collected these and other species from ARCN parks to test muscle tissue and other organs for metals (e.g. mercury) and persistent organic pollutants (POPs; e.g. organochlorine pesticides, polychlorinated biphenyl (PCB) congeners, and polybrominated diphenyl ethers (PBDEs)).
For more information, contact Angela Matz: angela_matz@fws.gov

The furthest-range pollutants are semi-volatile organic compounds (SOC's) including persistent organic pollutants (POP's), mercury, sulfur and nitrogen from Asian (and even eastern North American) sources.

Looking at landscapes



Landscape change over 30 years: Then and now

We documented changes in vegetation, water cover, and ice-wedge polygons across ARCN parks over the last 30 years by comparing recent (2008-2010) and c. 1980 aerial photography.

As we expected from previous research, shrub expansion across the tundra was the most common change observed. Shrub increases were noted at plots where summers had been relatively warm (estimated July mean temperatures: 52°- 57°F/11°- 14°C) and was more evident in NOAT and CAKR than other parks. Shrub increase was usually detected by the presence alders; due in part to the fact that this species is most visible on color-infrared images because of its large size. Tree expansion was also common in boreal forest areas that were undergoing post-fire succession.

Many other typical forms of arctic landscape change were recorded on just one or a few plots: formation of wetlands, expansion of water bodies and partial drainage of a lake by thermokarst, drying of a riverine lake, erosion of vegetation communities by migration of river channels, degradation of ice wedges, and revegetation of a thaw slump.

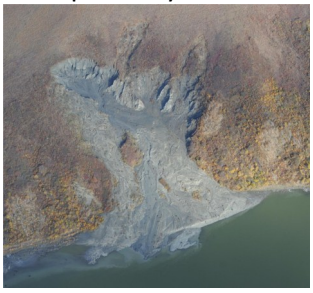
For more information on landscape change, contact Dave Swanson: dave_swanson@nps.gov

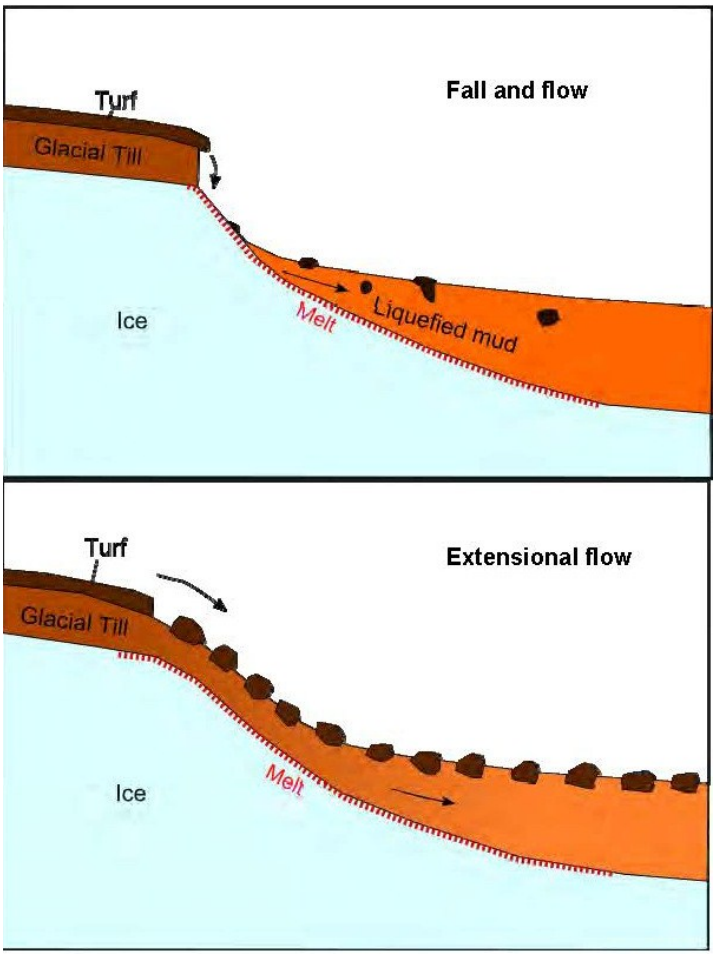
Thermokarsts ways of growing

This growing thermokarst slump (thawing permafrost feature) on the Noatak River (pictured here in a 3D model and in the photograph below) grew from 7.4 acres (3.0 ha) in 2011 to 8.4 acres (3.4 ha) in 2012. The main scarp (face) migrated up to 98 feet (30 m), releasing more than 1.5 million cubic feet (50,000 m^3) of material into the river which will likely affect water quality.

Active, rapidly migrating slumps grow by a process called *fall and flow*, where turf and sediments blocks fall down a near-vertical scarp and either disintegrate or sink into liquefied mud below. Slower, less active slumps grow by *extensional flow*— long fractures develop parallel to the main scarp, exposing less ice, and split turf into elongated blocks which survive their trip down the main scarp.

Slump activity in GAAR and NOAT varies greatly. Between 2010 and 2011 the main scarps of some slumps migrated just a few feet, while for others it migrated over 160 feet (60 m). We will continue to monitor change in these features.





Check out http://www.youtube.com/user/AlaskaNPS to watch a video about how we monitor thermokarst

Program updates and communications

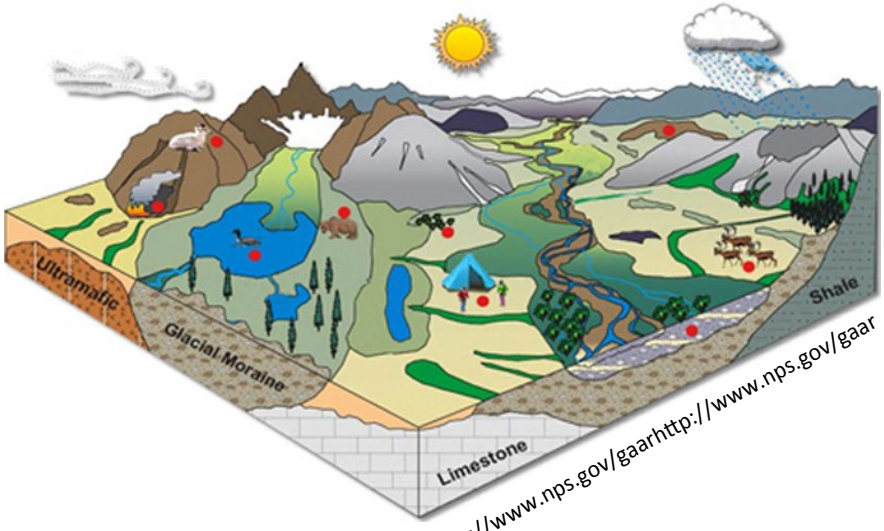
New staff

Jon O'Donnell, our new aquatic ecologist, will lead monitoring efforts for lakes and stream communities and ecosystems. Jon is interested in how climate and disturbance drive ecosystem processes in high-latitude regions. Jon received his Ph.D. from UAF where he worked to evaluate the effects of fire and permafrost thaw on soil carbon dynamics in interior Alaska. There he also received his M.S. degree on nitrogen cycling in the headwater streams of Caribou-Poker Creeks Research Watershed near Fairbanks. More recently with the US Geological Survey, he studied climate change and permafrost dynamics in the Yukon River basin. He collaborates with other arctic scientists on large-scale projects focused on permafrost dynamics and climate change.

Jeremy Mizel is our new wildlife biologist. He will lead monitoring efforts for landbirds (songbirds, ground-feeding birds, birds of prey, woodpeckers) in ARCN parks. Jeremy's research interests range from designing landbird monitoring programs to assessing how forest management affects song birds. His master's research at West Virginia University focused on forest songbird communities on abandoned surface mines and the response of cerulean warblers to silvicultural treatments.

A virtual ecosystem

If you visit the GAAR website, you'll find this image (right) under the *Nature and Science* tab. Here you can explore an array of multimedia features on topics such as: landscape dynamics, vegetation, permafrost, caribou, Dall's sheep, fire, brown bears, and birds. To learn about the biological and physical aspects of the subarctic and arctic systems, simply click a red circle icon next to the topic of your choosing. For more information contact Zachary Richter: zachary_richter@nps.gov

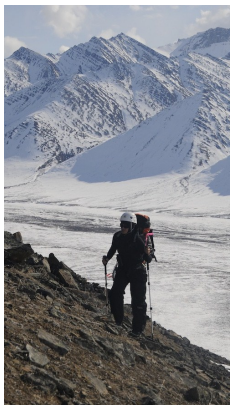


Moving to a better system– managing animal movement data

A lot of data can sometimes be too much of a good thing. That was the case for NPS biologists studying animal movements until the Animal Movement Database, developed with the Central Alaska and Arctic Networks and the NPS Alaska Region GIS team, came onto the scene. Currently, we use this tool to track wildlife movements across Alaska. GPS locations, from the GPS collars, are transmitted to park biologists via a satellite network and the Animal Movement tool in ESRI ArcGIS processes and inserts the GPS fixes into a Microsoft SQL Server database. For more information, contact Scott Miller: scott_miller@nps.gov

From the field

Rolling off my sleeping pad, the cold ground seeps through my sleeping bag. I hear the door of the tiny woodstove open and the thud of wood against its walls; Kumi is signaling the crew that it's time to emerge from our synthetic cocoons. Today's first challenge is to find my way out of this bag– where is the zipper? A fire begins to crackle now, and the Whisperlight stove spurts and hums– coffee is on it's way, hooray! Willow ptarmigan cluck about the tent while we tend to blisters on our feet from yesterday's journey. A lone northern shrike screams.



It's mid April here in the upper Itkillik Valley (GAAR) and we are collecting fecal pellets (poop) to assess the health of Dall's sheep and caribou in this area. Today we will ski seven miles from camp and ascend several hundred feet of the mountain where we found sheep foraging yesterday. We will bag their pellets and later analyze them for diet quality and composition. It will take all day to accomplish this task, but the sun is shining and the days are long.

For more information, contact Kumi Rattenbury: kumi_rattenbury@nps.gov

Thanks to volunteer Heike Merkel for her efforts on this project.

Fresh and frozen fecal pellets can provide information about animal diets, genetics, parasites, and hormone levels. Last April, we collected samples from 20 different caribou pellet piles and 37 sheep piles, 5 of which were from giant sheep beds (below).

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